Economic framework for assessing measures

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Economic framework for assessing measures

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Outline

1. Introductory remarks
2. cost benefit analysis - approach
3. Example
4. Concluding remarks

Who does What in the steps of barriers and measures identification

Consultant

- Preparation of workshop
  - Existing studies
  - Economic analysis

Workshop

- Barrier analysis
  - Brainstorm
  - Market mapping
  - Root cause analysis
  - Arranging the barriers
- Identifying measures
  - Identifying measures
  - Grouping measures
  - Initial prioritizing of measures

Consultant

- Consolidating results
  - **Assessing measures**
  - Grouping measures for several technologies

Introductory remarks

MCA:

Qualitative indicators

(e.g. acceptability to local stakeholders)

Quantitative indicators

(e.g. capital costs, incremental costs, abatement costs)

Barrier analysis and enabling framework: quantitative assessment of costs and benefits is required!

Introductory remarks

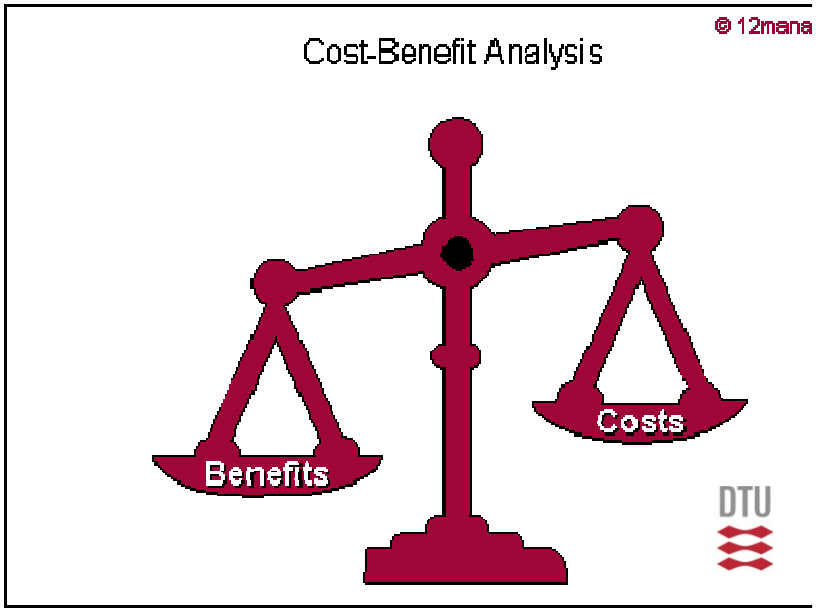
TNA Barrier Handbook

Measures

Any factor that enables or motivates a particular course of action or behavioral change with the objective of overcoming a barrier

Selected measures should assessed according to:

- Socio-economic assessment
  - cost benefit analysis
  - cost effectiveness analysis
- Financial assessment
  - capital cost



Cost benefit analysis **(CBA)**

Cost benefit analysis (CBA) is a technique for assessing the **monetary costs and benefits** of implementing a technology **over a given time period**

The principles:

- Can show that it is feasible – or not - and acceptable to Transfer and diffuse a particular technology.

- include externalities :
  - social/environmental impacts as well as
  - 'private' economic costs and benefits so that externalities are incorporated into the decision process. In this way,

- Time matters! CBA can take account of the economics of time – known as discounting.

The impacts of a project are defined for a particular study area (city, region, country)

Cost benefit analysis **(CBA)**

Process

1. Based on the barrier analysis, you have identified measures to include for overcoming the identified barriers.

2. For each measure estimate costs

3. Estimate benefits of the technology

4. Apply discount rate.

5. Calculate net present value of the selected set of measures

Step 1. List alternative measures to overcome barriers for the transfer and diffusion of the selected technology and group the measures

Identification of measures through:

- the TNA Consultant's own experience,
- documented experience on policy measures from other countries
- inputs from the barrier analysis
- market mapping tool (consumer goods and capital goods)
- logical problem analysis

– Make a selection of complimentary measures

Promotion of the diffusion of renewable energy source

- **Loan guarantees**
- **Production incentives (e.g.,subsidy per produced kWh electricity)**
- **Standard power purchase agreements**
- **Investment subsidies**

- **Information and education**
- **Improved infrastructure**
- **Improved access to the grid**

Cost benefit analysis **(CBA)**

Step 3 and 4. **Calculation of costs and benefits.**

*This process is very important – it involves trying to identify all of the **significant** costs & benefits*

- This would include calculation of:
  - **Tangible Benefits and Costs** (i.e. direct costs and benefits)
  - **Intangible Benefits and Costs** (i.e. indirect costs and benefits – externalities)
- The estimation of benefits and costs should take into account benefits and costs arising over time
- For adaptation technologies, some benefits arise only in the presence of climate change.

  →then calculations should be based on a scenario which assumes that future climate change impacts are known with certainty, e.g. 1 or 2 degree increase in temperature

Cost benefit analysis **(CBA)**

Step 4. **Discounting the future values**

Costs and benefits arising over time need to be discounted to render current and future effects comparable. $1 today has more value than $1 in 10 years, and therefore future values need to be discounted by a discount rate representing the preference for the present over the future.

Discount rates typically range from 0 to 10 percent.

- high discount rate will make future costs of the technology less, and hence make investments more attractive in comparison to an assessment using low discount rates.

The NPV is calculated as the sum of the present values of annual net benefits.

Cost benefit analysis **(CBA)**

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Step 5. **Calculating Net Present Value (NPV)**

$$NPV = \sum \frac{Net\ \ Benefits_t}{(1+i)^t},$$

where *Net benefits = benefits – costs,*

t is the year, and *i* is the discount rate.

Year, t		Net benefits, 5% discount rate	Net benefits, 10% discount rate
1	$\frac{234-105}{(1+0.05)^1}$	123	117
2	$\frac{234-30}{(1+0.05)^2}$	185	169
3	$\frac{234-30}{(1+0.05)^3}$	177	154
4	$\frac{234-30}{(1+0.05)^4}$	168	140
5	$\frac{234-30}{(1+0.05)^5}$	160	127
6	$\frac{234-30}{(1+0.05)^6}$	153	115
7	$\frac{234-30}{(1+0.05)^7}$	145	105
8	$\frac{234-30}{(1+0.05)^8}$	138	95
9	$\frac{234-30}{(1+0.05)^9}$	132	87
10	$\frac{234-30}{(1+0.05)^{10}}$	125	79
NPV, USD		**1,506**	**1,187**

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If NPV > zero, then the transfer and diffusion of the technology is profitable with the selected combination of measures.

If NPV < zero, the longer term costs of the transfer and diffusion with the selected combination of measures are larger than the benefits.

If NPV = 0, the transfer and diffusion with the selected combination of measures adds no monetary value (selection can be based on other criteria, e.g. political priority etc)

CBA - issues

- **Problems in attaching valuations to costs and benefits**
  - Some impacts are easy to value such as the running costs (e.g. staff costs) + capital costs (new equipment). Other impacts are more difficult (environment, life,..)

- **The CBA may not cover everyone affected**
  - CBA cannot hope to include all stakeholders

- **Distributional consequences** (poor vs. non-poor)
  - Costs and benefits mean different things to different income groups

Example intro

Technology (adaptation, agriculture):

drought resistant crops

- Improved maize in Malawi
- target 1.5 million households

- cultivated by 97 % of farmers
- occupying 54% of the land cultivated by small-scale farmers, and
- contributing 54% of the caloric intake on average

Key barrier to transfer and diffusion:

limited acceptance of improved maize among rural households

Target:

to make drought resistant crops (maize) more acceptable in local communities

Example - Step 1: Measures

Step 1: List alternative measures to overcome barriers for the transfer and diffusion of the selected technology

- subsidies, awareness raising, access, know how, local consultants, rural policies, irrigation access, etc…

.. and make a selection of complimentary measures

a) subsidies to cover a share of additional costs (compared to "normal" crops)

b) ensure access to seeds and fertilizer

c) awareness and knowledge raising among farmers

Example – Step 2: Calculate costs

Costs

1. subsidies to cover a share of additional costs
   - costs estimated compared to price of “normal” seeds

2. ensure access to available seeds and fertilizer through stable market access and supply by retailers
   - costs related to rural policies, infrastructure

3. awareness and knowledge raising among farmers
   - cost of trainers, workshops, training material, introduction package)

Example – Step 2: Calculate costs (cont)

1. **Costs: Subsidies to cover a share of additional costs (compared to "normal" seeds)**

Annual cost of subsidies*

- 2 million seed (improved maize)/ 4 500 tonne
- Subsidies: USD 9000 per tonne improved maize seeds
- total = 9000 * 4 500

- **Total cost per year = USD 51 million**

Issuess to include in discussion

- may be ineffective
- public good aspect or benefit a group of farmers?
- high cost
- difficult to remove

* Wiggins & Brook (2010): http://www.oecd.org/dataoecd/50/35/46340359.pdf

Example – Step 2: Calculate costs (cont)

2. Costs: Ensure access to available seeds and other inputs (fertilizer etc) through stable market access and supply by retailers

- Rural policies
- Priority to infrastructure.

We assume this is part of general development policies and therefore we do not include costs!

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Example – Step 2: Calculate costs (cont)

3. **Costs: Introduction programme: awareness and knowledge raising among farmers**

- trainers, workshops, training material, starter package

Targeted starter packs of seed and fertilizer sufficient to plant one tenth of a hectare were introduced in the first year, intended to allow small farmers to learn of the benefits of the package, to increase food production, and improve their incomes.

- a representative pack was estimated at **USD 18 per household** incl. training and information

- total introduction programme cost = USD 18 * 1,500 000 households

  = **USD 27 million**

Example – Step 2: Calculate costs (cont)

- Other inputs: land, labor and fertilizer (costs to households):

  Annual cost of land: Cost is set to zero - no incremental/additional costs compared to baseline!

  Annual cost of labour: Cost is set to zero – no incremental/additional costs compared to baseline!

  Annual cost of fertilizer: USD 11 for 50 kg (3,646,000 backs for 1,500,00 hh/2,058,823 ha)

  USD 40 million

- total cost = (subsidy of improved seeds + market access/rural policies + introduction programme + other inputs (labor, land, fertilizer))

- Total cost (USD) $_{\text{year 1}}$ = 51 million + 0 + 27 million + 40 million
  = 118 million
- Total cost (USD) $_{\text{year 2}}$ = 51 million + 0 + 0 + 40 million
  = 91 million

Example – Step 2: Calculate benefits

To calculate benefits, we need to know

- crop yields
- market price

Benefits: income measured from increase in crop yields.

Crop yield:

- Annual increase from 0.7 to 1.7 tonne per hectare
- total annual increase:1.2 million tonne to 3.5 million tonne

We assume crop yields to be sold in markets !

Market Price: **USD 110 per tonne maize***

Adaptation benefit $_{year\ 1}$ = 1,300,000 * 110

= USD 143,000,000

*Minot (2010)
http://ageconsearch.umn.edu/bitstream/58558/2/AAMP_Maputo_22_Malawi_ppr.pdf

year	Tonnes, millions	Adaptation benefit (tonnes, millions)
baseline /0	1.2	0
1	2.5	1.3
2	3.4	2.2
3	3.2	2.0
4	3.5	2.3
5	3.5	2.3
6	3.5	2.3
7	3.5	2.3
8	3.5	2.3
9	3.5	2.3
10	3.5	2.3

1. Select discount rate and calculate net present value of the selected set of measures

   a) 4 %

   b) 7 %

$$NPV = \sum \frac{Net\ Benefits_t}{(1+i)^t},$$

Year	Benefits total	Costs total	Net Benefits	Discounted Net Benefits 4%	Discounted Net Benefits 7%
1	143,000,000	118,000,000	25,000,000	23,809,524	23,364,486
2	242,000,000	91,000,000	151,000,000	139,607,988	131,889,248
3	220,000,000	91,000,000	129,000,000	114,680,530	105,302,426
4	253,000,000	91,000,000	162,000,000	138,478,279	123,589,024
5	253,000,000	91,000,000	162,000,000	133,152,191	115,503,761
6	253,000,000	91,000,000	162,000,000	128,030,953	107,947,440
7	253,000,000	91,000,000	162,000,000	123,106,686	100,885,458
8	253,000,000	91,000,000	162,000,000	118,371,813	94,285,475
9	253,000,000	91,000,000	162,000,000	113,819,051	88,117,266
10	253,000,000	91,000,000	162,000,000	109,441,395	82,352,585
NPV				**1,142,498,411**	**973,237,171**

Concluding remarks

- Could add how much costs would represent of total government budget!
- Costs seem high – but not compared to benefits!
- Political decision – budget allocation (e.g. maize growing farmers)
- Uncertainties:
  - climate,
  - crop prices
  - GHG reduction potential
  - operation and maintenance costs

  → sensitivity analysis

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Thank you !

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